Transportation Air Quality and MOVES Training

Module 1: Transportation Conformity & Regional Emissions Analysis

Note: This material is part of a five module training course prepared by the Texas A&M Transportation Institute (TTI) for the Texas Department of Transportation. Please review the training description document for further details and for TTI contact information

Objective

- Transportation Air Quality Overview
- State Implementation Plan and Budgets
- Conformity Process and Triggers
- Overview of Conformity Elements
- Latest Planning Assumptions and Models
- Conformity Demonstration
- Pointers

Transportation Air Quality

Overview

Air Quality & Public Health

- Air pollution causes 200,000 early deaths each year in the U.S.
  - **53,000** can be attributed to contributions of road transportation emissions.

NO_x
- Irritates airways, especially lungs.

VOCs
- Triggers conjunctival irritation, nose and throat discomfort, cancers, etc.

O_3
- Triggers reactions in people who have asthma.

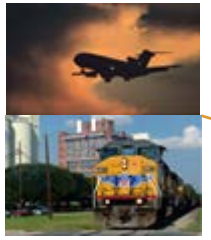
CO
- Decreases the ability of your blood to carry oxygen

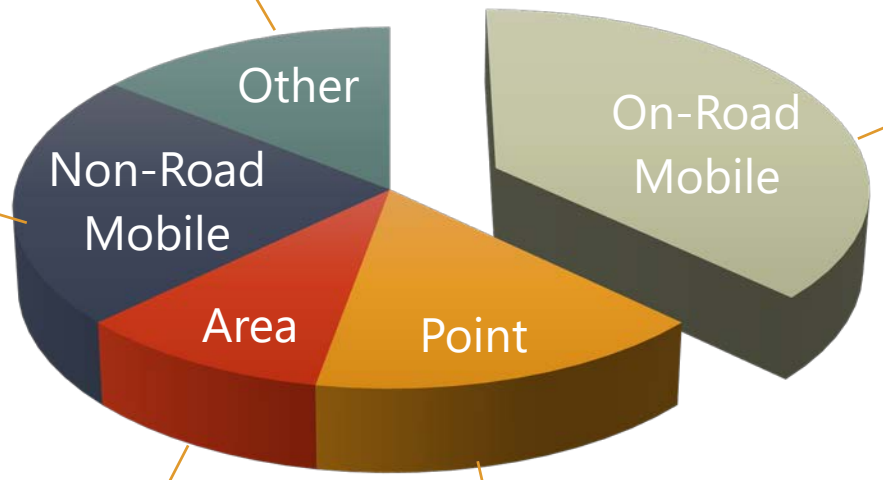
PM
- Aggravates symptoms in individuals who already suffer from respiratory or cardiovascular diseases.

Emission Sources

Emissions from biogenic sources, e.g., crops, lawn grass, and trees

Emissions from vehicles or equipment that are not operated on roads or highways





Emissions from on-road vehicles

Regulated as part of **Transportation Conformity**

Emissions from small stationary and non-transportation pollution sources

Emissions from fixed or large facilities

Federal Air Quality Regulations

- Clean Air Act (CAA), 1970
  - 40 CFR Part 50
  - Established national ambient air quality standards (NAAQS) and six criteria pollutants
  - Established requirements for state implementation plan (SIP)
- CAA Amendments, 1977
  - Introduced transportation conformity
- CAA Amendments, 1990
  - Current legal authority
  - Expanded transportation conformity provisions
    - Identified the actions states/MPOs must take to reduce emissions from on-road mobile sources in nonattainment/maintenance areas
  - Established 5-year NAAQS review period

National Ambient Air Quality Standards

- Standards for criteria pollutants (considered harmful to public health and the environment)
  - Primary standards (public health)
  - Secondary standards (public welfare protection)

Pollutant		Primary/ Secondary	Averaging Time	Level	Form
Ozone		Primary and Secondary	8-hour	0.070 ppm	Annual fourth-highest daily maximum 8-hr concentration, averaged over 3 years
Particle Pollution	$PM_{2.5}$	Primary	Annual	12 µg/m^3	annual mean, averaged over 3 years
		Secondary	Annual	15 µg/m^3	annual mean, averaged over 3 years
		Primary and Secondary	24-hour	35 µg/m^3	98th percentile, averaged over 3 years
	PM_{10}	Primary and Secondary	24-hour	150 µg/m^3	Not to be exceeded more than once per year on average over 3 years

Area Designations

- Designated based on air quality monitoring and comparison with NAAQS
- Done by TCEQ in Texas
- New designations required when NAAQS are revised

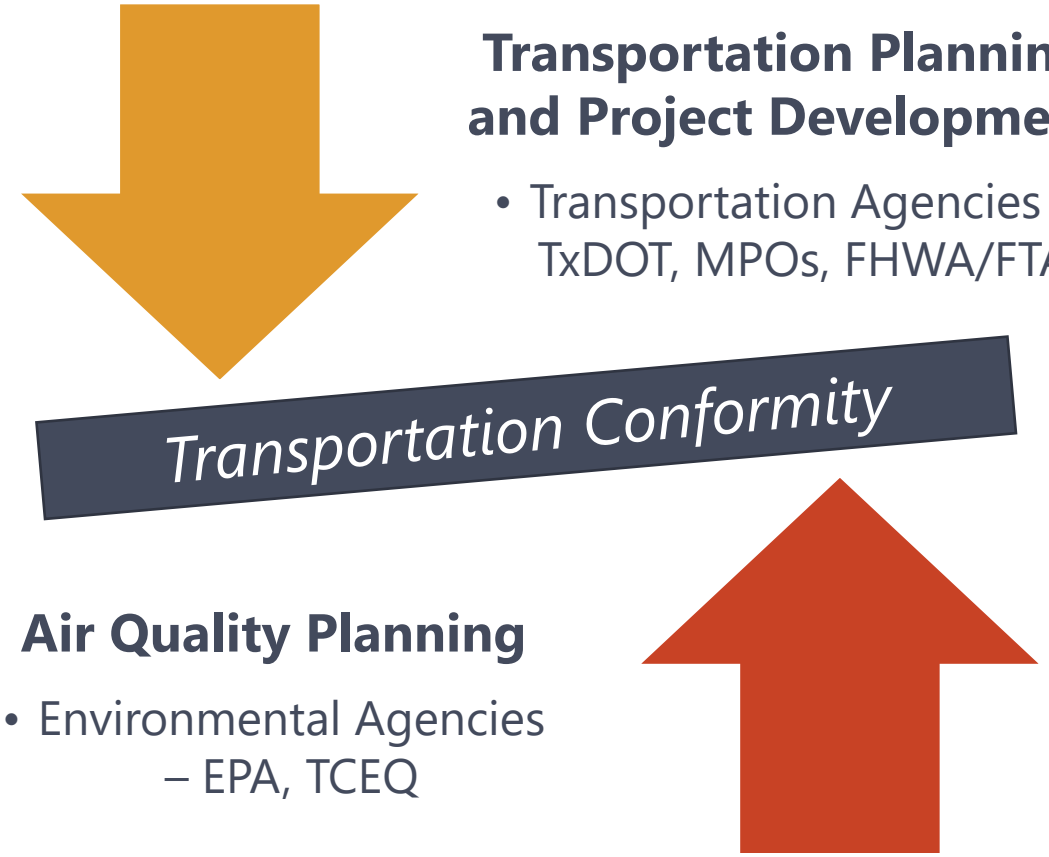
Attainment	Maintenance	Nonattainment
Meet all NAAQS	Meet all NAAQS, but previously violated	Does not meet NAAQS

Transportation Conformity

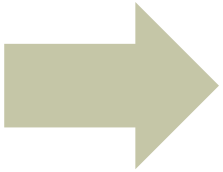
Requirements

Transportation Conformity

Federally-required mechanism to ensure transportation plans or programs are consistent with air quality goals



Criteria Pollutants



- Key transportation-related pollutants
- Conformity is required

Carbon Monoxide

Particulate Matter

Nitrogen Dioxide

Ozone (O_3)

Precursors:

Oxides of Nitrogen

Volatile Organic Compounds

Sulfur Dioxide

Lead

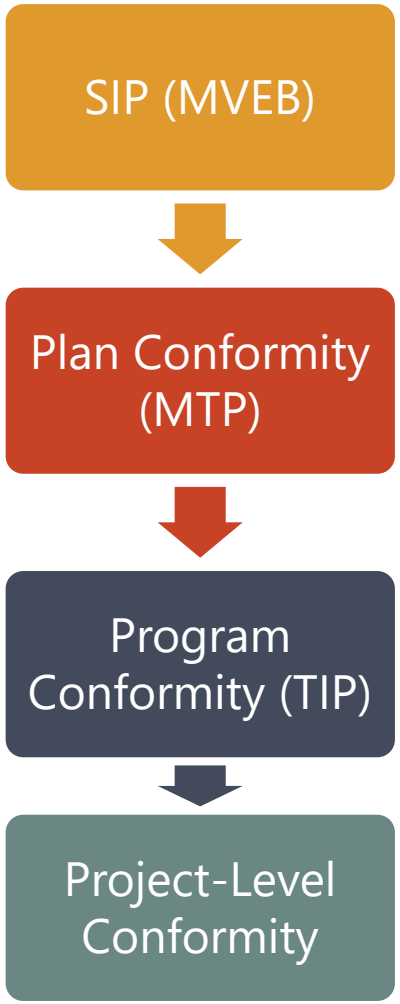
Conformity Triggers

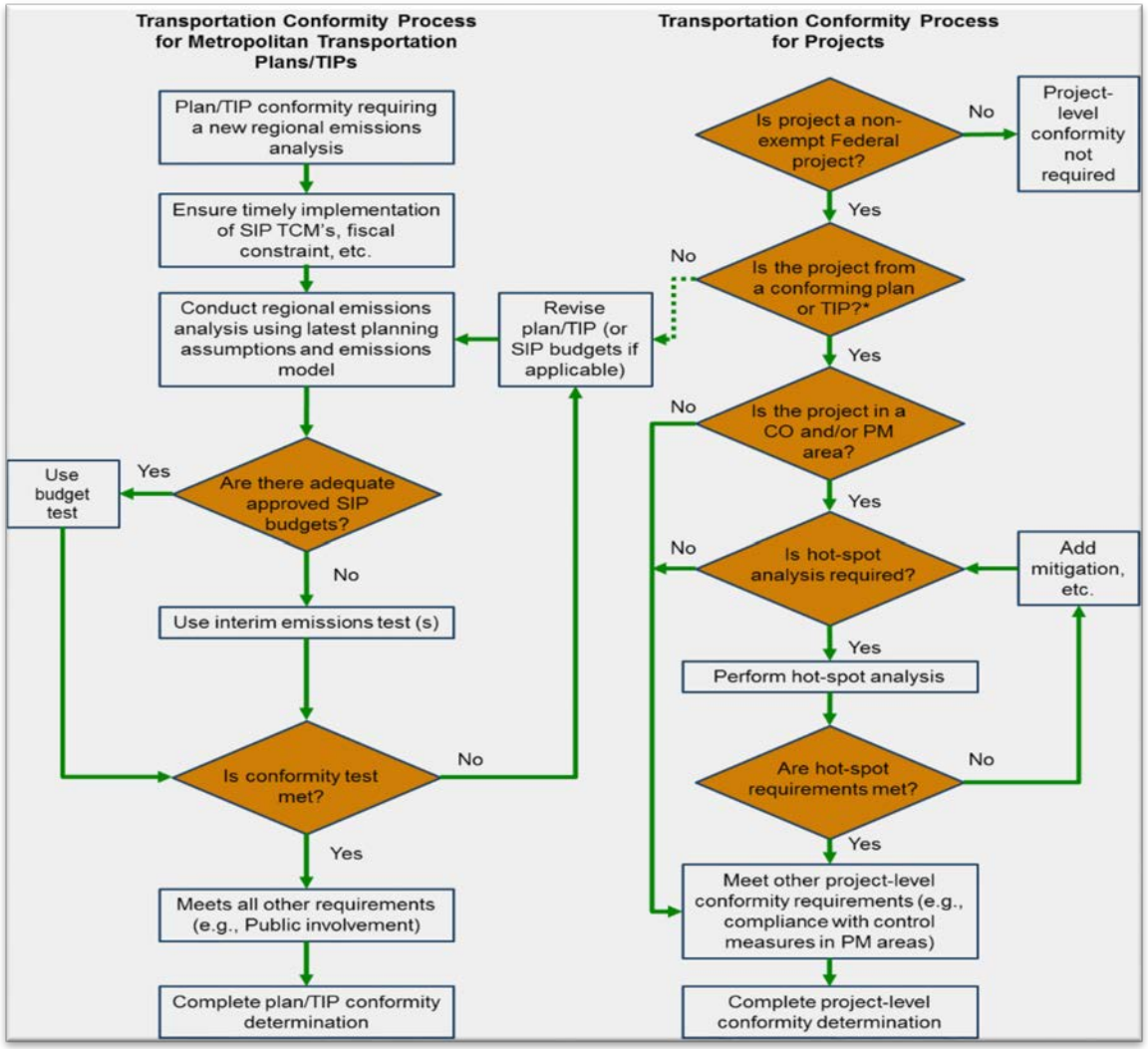
Conformity must be demonstrated:

- At least every 4-years (nonattainment and maintenance areas)
- Prior Approval of Metropolitan transportation plan, a TIP, and plan / TIP amendments
- Prior to approval of federal projects
  - Federal projects involving FHWA/FTA approval or funding
  - Projects must be included in a conforming plan and TIP
- 24-months after certain SIP actions
- 12-months after new nonattainment designation becomes effective

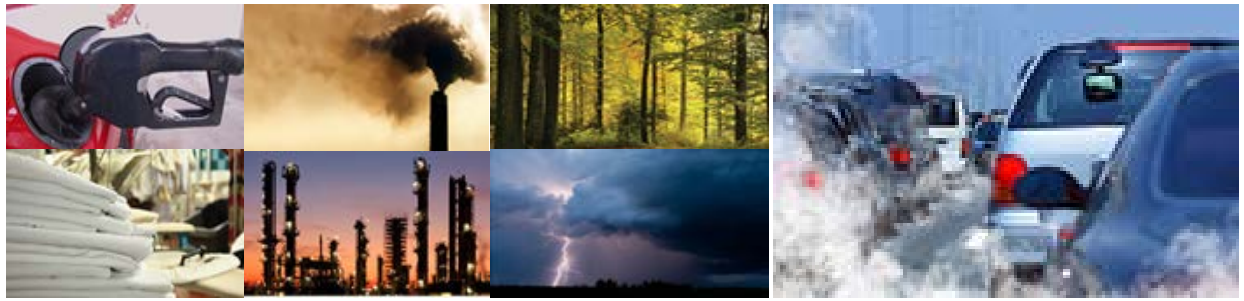
Transportation Conformity Overview

- Applies to nonattainment and maintenance areas
- Applies to:
  - MTP
  - TIP
  - Non-exempt projects with FHWA/FTA funding or requiring FHWA/FTA approval at any stage





Source: Transportation conformity: A Basic Guide for State and Local Officials http://www.fhwa.dot.gov/environment/air_quality/conformity/guide/



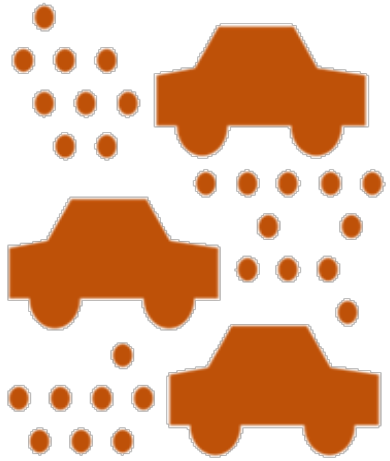
State Implementation Plan and Motor Vehicle Emissions Budget

State Implementation Plan

Definition	Purpose of the SIP	In Texas
• State air quality plan to attain NAAQS • Required per the CAA • Covers all pollutant sources	• Eliminate/reduce violations of the NAAQS • Expedite attainment of the NAAQS	• TCEQ is responsible for the SIP • Set of plans, procedures, and strategies developed by TCEQ

Motor Vehicle Emissions Budget (MVEB)

- *"...portion of the total allowable emissions defined in the submitted or approved control strategy SIP revision or maintenance plan for a certain date for the purpose of meeting reasonable further progress milestones or demonstrating attainment or maintenance of the NAAQS, for any criteria pollutant or its precursors, allocated to highway and transit vehicle use and emissions."* (40 CFR 93.101)

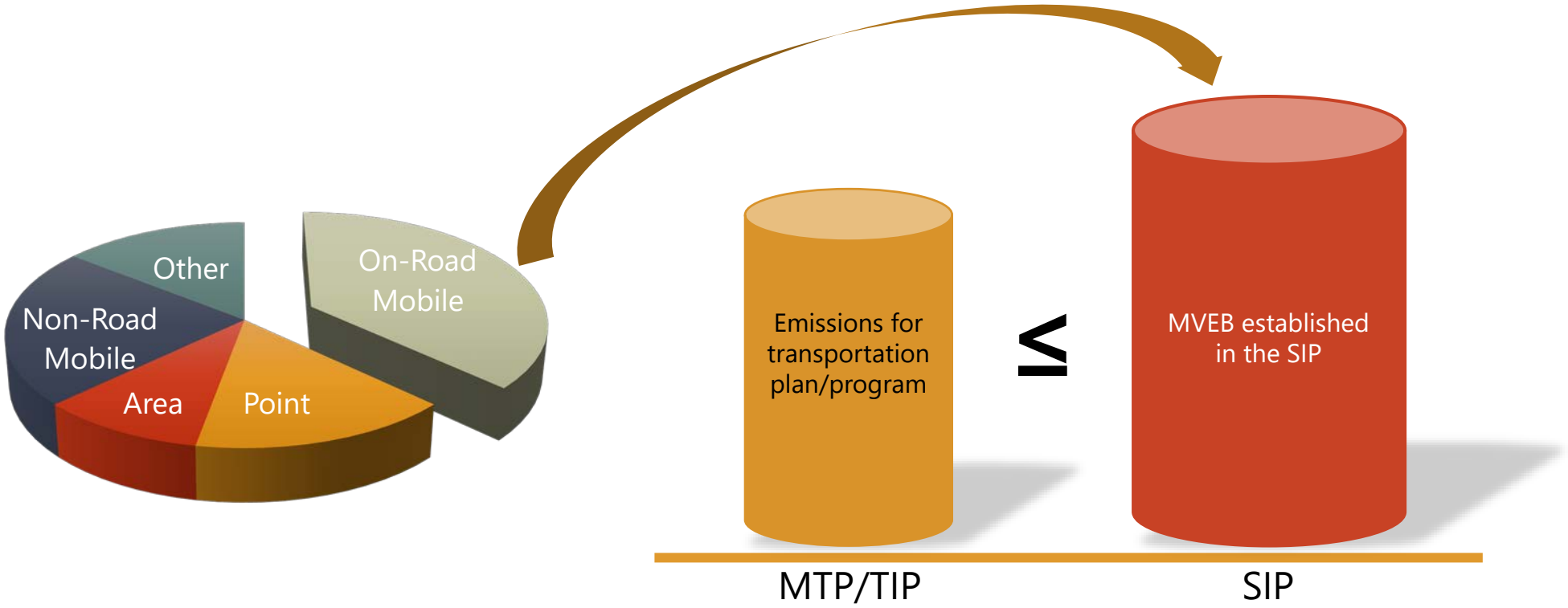


- i.e. a limit for pollutants from all regional motor vehicle activities

SIP, Transportation Conformity and the MVEB

All federally funded transportation projects/plans must conform to the SIP, which is determined through the transportation conformity process

SIP sets the motor vehicle emissions budget (MVEB) for conformity purposes



Transportation-Related Emission Control Strategies

SIP Control Strategies/Control Measures

Transportation-related

Related to other sources

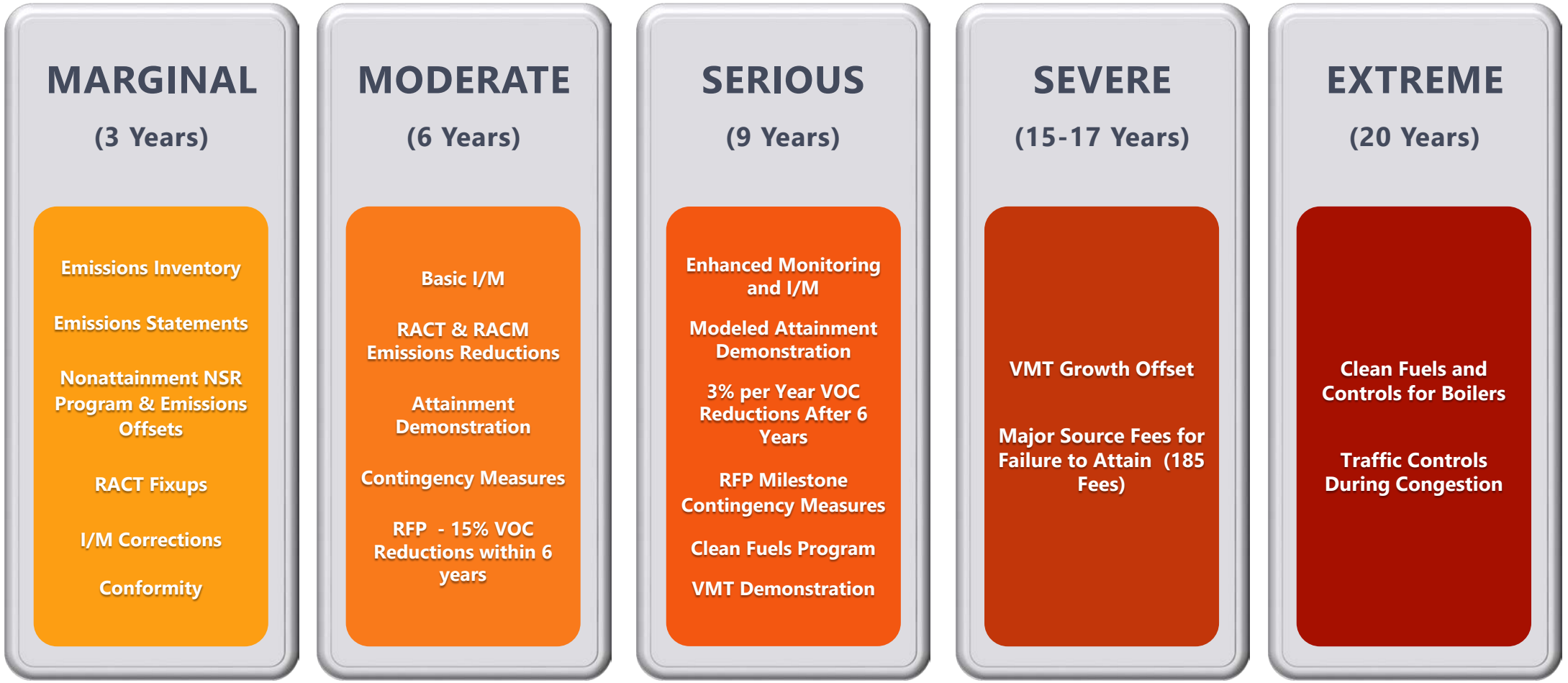
Transportation control measures (TCMs)

Other

Reduce vehicle use or improve traffic flow

I/M, vehicle and fuel technologies, etc.

Requirements Based on the Designations



Source: TCEQ

Transportation Conformity

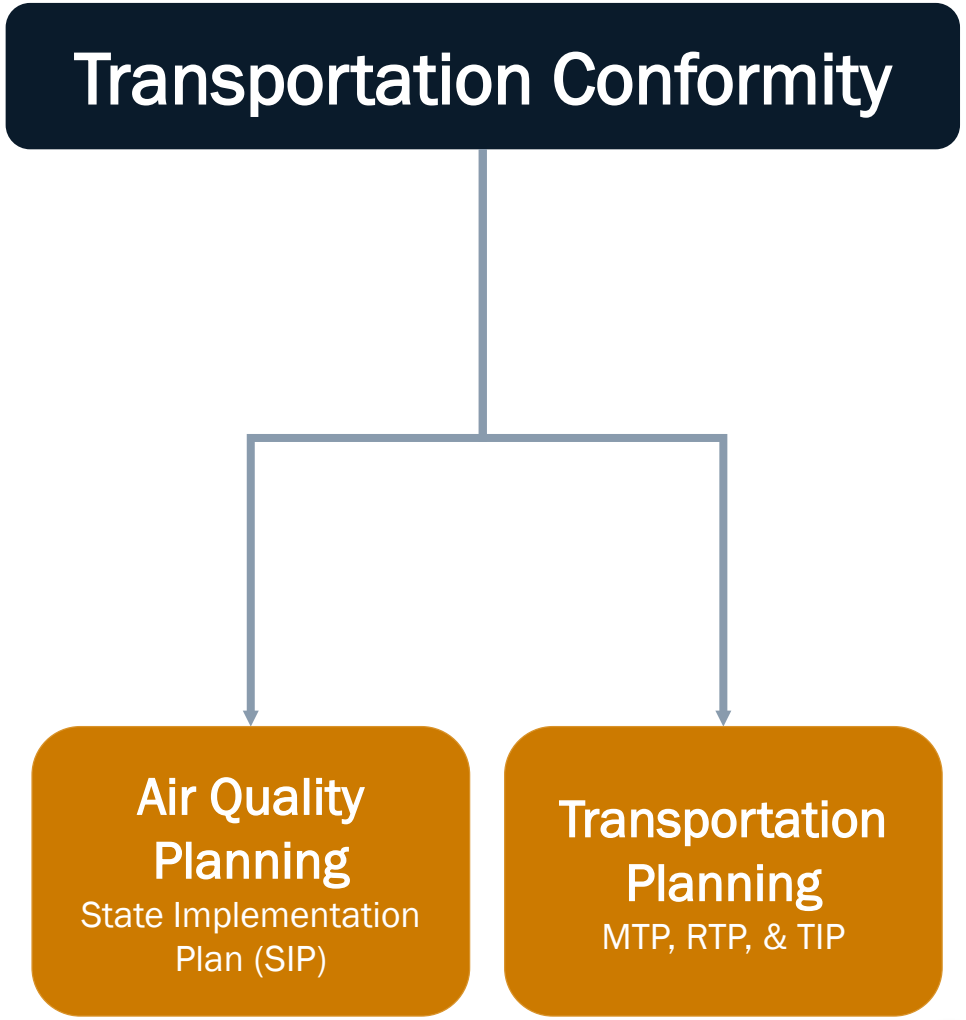
Conformity Determination Process

Transportation Conformity

Ensures that transportation plans, transportation improvement programs, and projects funded or approved by the Federal Highway Administration (FHWA) or the Federal Transit Administration (FTA) will conform to air quality goals set by the SIP

Ensure those transportation activities will not:

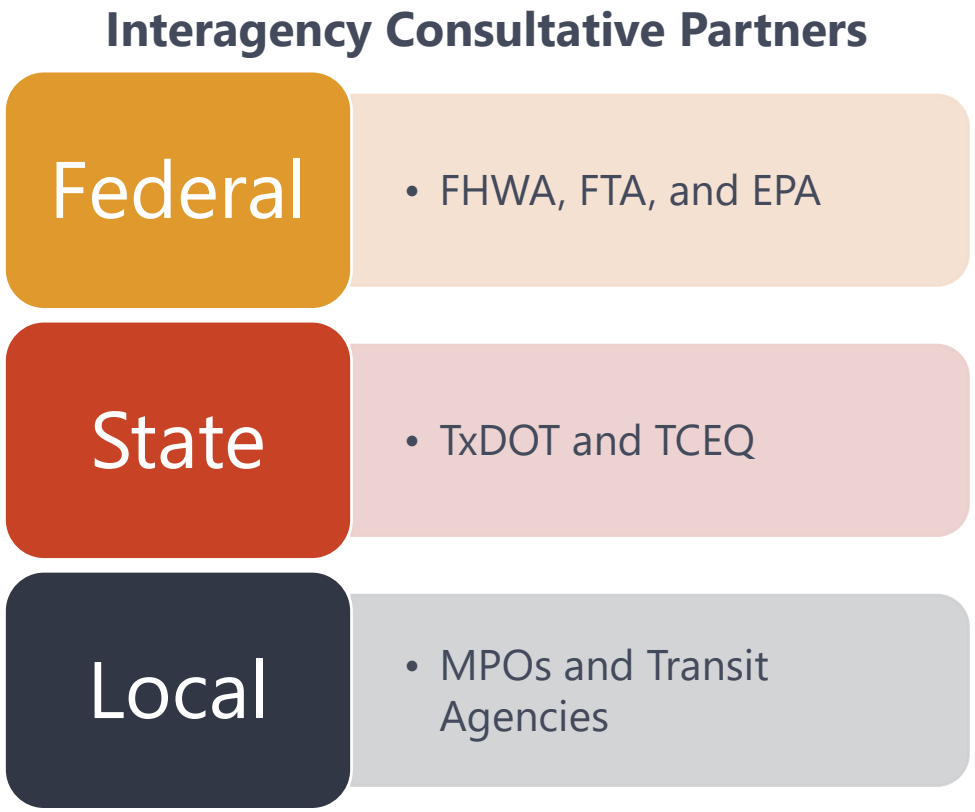
- Cause new air quality violations
- Worsen existing violations
- Delay timely attainment of NAAQS, interim reductions or milestones



Major Components of a Conformity Determination

Interagency Consultation

- **Consultation is required on development of:**
  - SIPs
  - MTP/TIPs
  - Conformity Determinations
- **Technical Working Group (TWG)**
  - Provides statewide technical coordination in Texas



Interagency Consultation: Key Elements

Consultation process must include:

- Roles and responsibilities
- Frequency for convening consultation meetings
- Evaluate events which trigger new conformity determinations
- Assure MPO is notified of regionally significant non-federal projects

Interagency Consultation: Roles and Responsibilities

Regulations require the participation of all relevant agencies in interagency consultation

- Not all agencies are required to participate in every activity covered by interagency consultation

Typical key participants include:

- MPO(s)
- State transportation agency
- State air quality / environmental agency
- US DOT (FHWA/FTA)
- US EPA

Interagency Consultation: Best Practices

Continuous with periodic meetings

Key decisions are made early in the process

Discussions and determinations are well documented- Consensus Plan

- Agreements
- Assumptions
- Meeting agendas and notes

Major Components of a Conformity Determination

Public Involvement Requirements

Follow requirements in 23 CFR 450.316(a)

Proactive public involvement process

Reasonable public access to technical and policy information

Public involvement must occur prior to taking formal action on a conformity determination

Major Components of a Conformity Determination

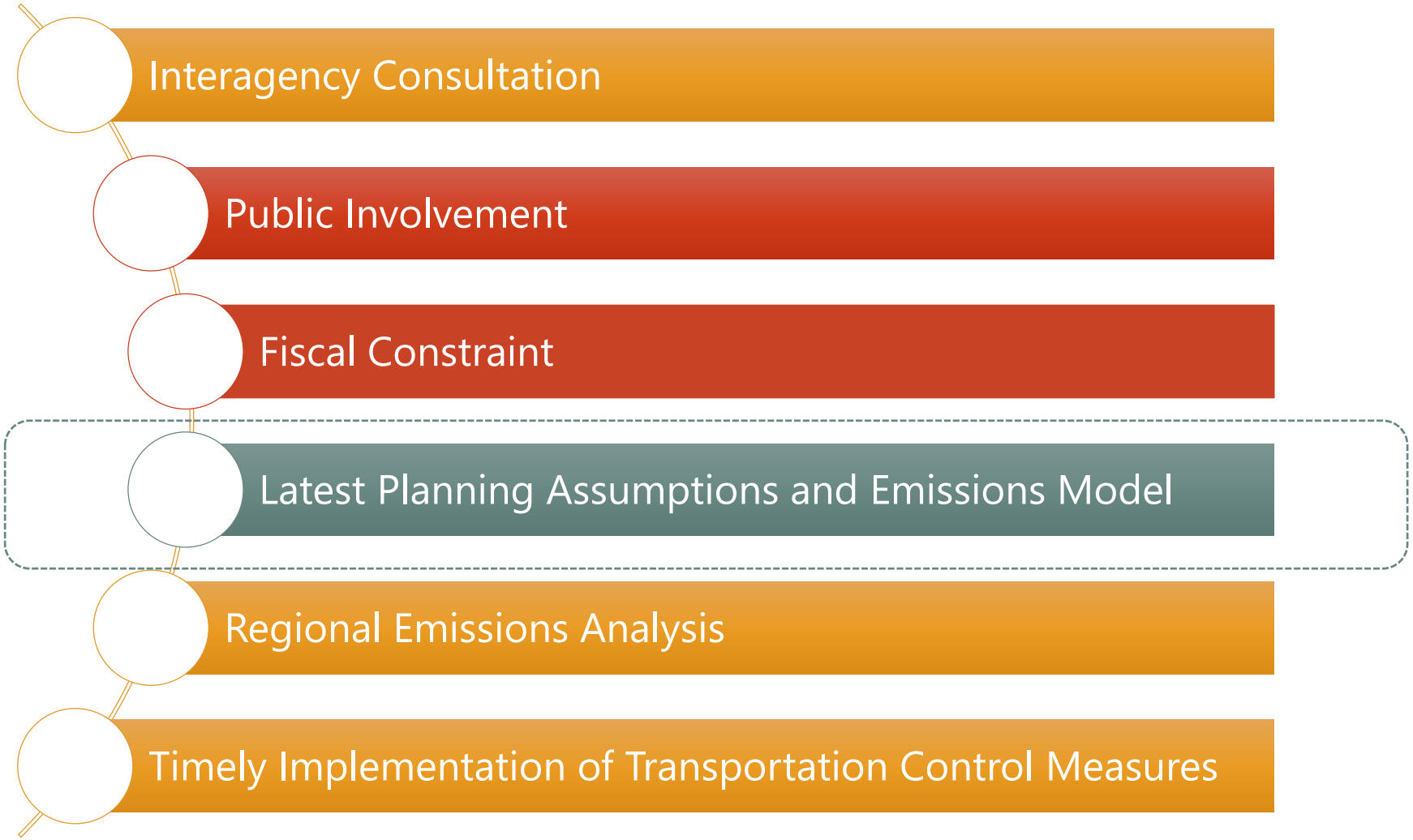
Fiscal Constraint

Important part of general transportation planning and programming

Requirements are more stringent in nonattainment and maintenance areas

- Determination can only be made on a fiscally constrained TIP/MTP
- Projects can be included in the first two years of the TIP and STIP only if funds are “available” or “committed”

Major Components of a Conformity Determination



Latest Planning Assumptions and Emission Model

Make use of latest planning assumptions

- i.e., based on the most current information that is available to state and local planners, e.g. MPO, to make their MTP/TIPs
- reflect latest planning, population, employment, travel, vehicle age and fleet mix, and congestion estimates

Make use of the latest EPA emission model (MOVES model)

Latest Planning Assumptions

Regardless of what SIP or Budgets is based on, CAA also requires use of latest planning assumptions

- Population, employment
- Fleet mix and age
- Speed data, etc.

Updates to assumptions can result in increases in modeled emissions

SIP revisions may be necessary for conformity to continue

Congress revised requirement to reflect use of assumptions in place when analysis starts

Latest Emission Model

CAA requires use of the latest emissions model, regardless of which model version of the model was used in the SIP

Updates to the emissions model often result in increases in modeled emissions of some pollutants

SIP revisions are often necessary for conformity to continue, but these take time

- EPA has a policy for expedited SIP revisions, which can help if reductions under new model are at least as large as under older model

Major Components of a Conformity Determination

Regional Emissions Analysis

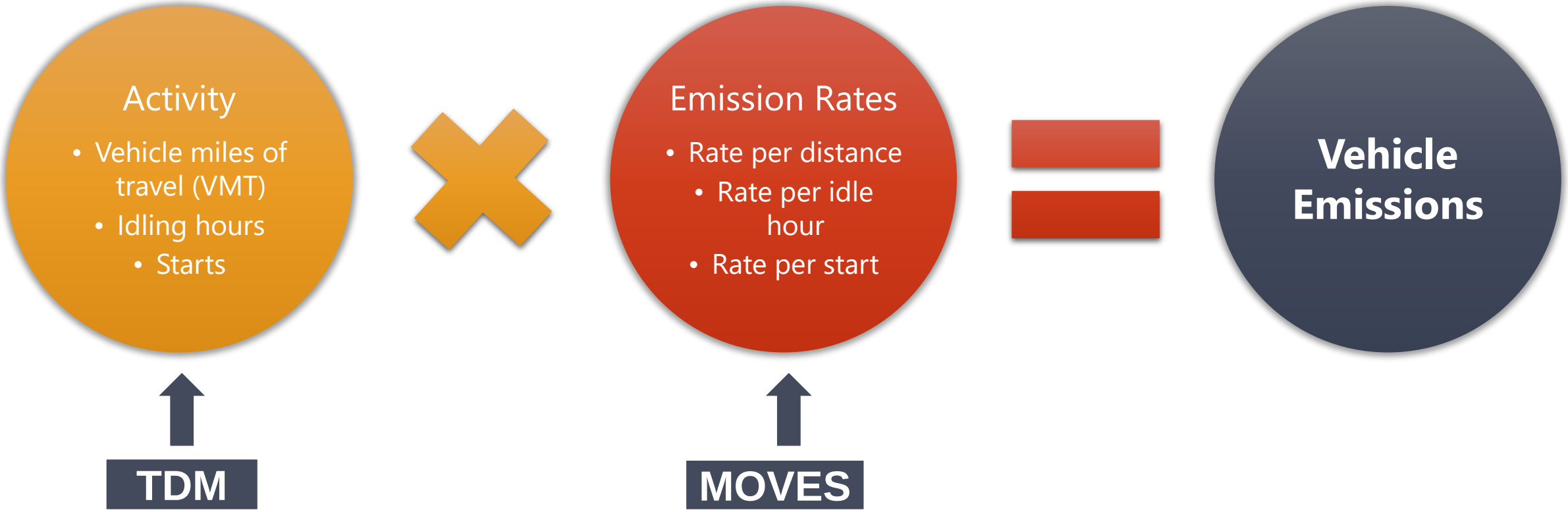
Assessment of regional transportation-related emissions

Determines the estimated emissions impacts of existing and proposed transportation projects

Demonstrates that emissions from implementing the transportation plan and TIP are consistent with the SIP

Regional Emission Analysis

- The key analytical component of the conformity determination



Regional Emissions Analysis – Conformity Tests

Motor Vehicle Emission Budgets

- Established in the adequate or approved SIP
- Establishes a cap on emissions
- Set for a certain date(s) to meet a milestone or demonstrate attainment or maintenance of the NAAQS

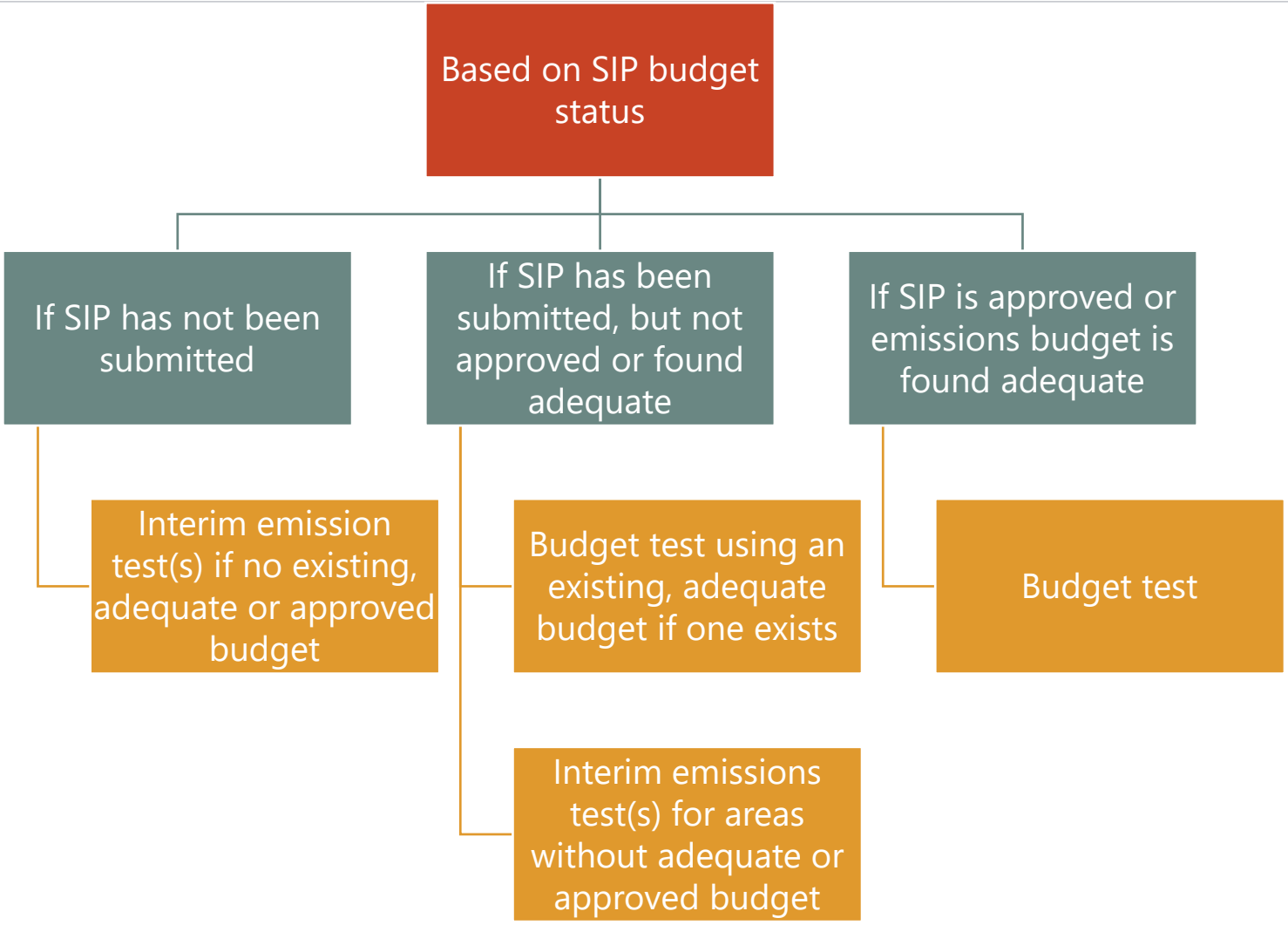
Interim Emissions Tests

- Build/no-build test
  - Emissions from Implementing plan or TIP $\leq$ Emissions without plan & TIP implementation
- Baseline test
  - compares emissions from a baseline year to emissions resulting from implementing plan and TIP

Conformity Analysis Years

- Must include
  - The designated attainment year, if applicable
  - The last year of the transportation plan
  - Must be not more than 10 years apart

Regional Emissions Analysis– Conformity Test Selection



Vehicle Miles of Travel: Adjustments

Highway Performance Monitoring System (HPMS) Factor	• Adjust modeled VMT to reconcile with HPMS data
Non-Recurring Congestion Factor (optional)	• Adjust the speed on freeways to accounts for incidents
Hourly Factors	• Allocate modeled VMT into different hours
Seasonal Conversion Factors	• Convert modeled VMT to seasonal VMT
Daily Conversion Factors	• Convert modeled VMT to different day-type VMT

Vehicle Miles of Travel: HPMS Factor

40 CFR 93.122(b)(3): "an HPMS adjustment factor may be developed to reconcile and calibrate the network-based travel model (e.g., TDM) estimates of VMT in the base year of its validation to the HPMS estimates for the same period".

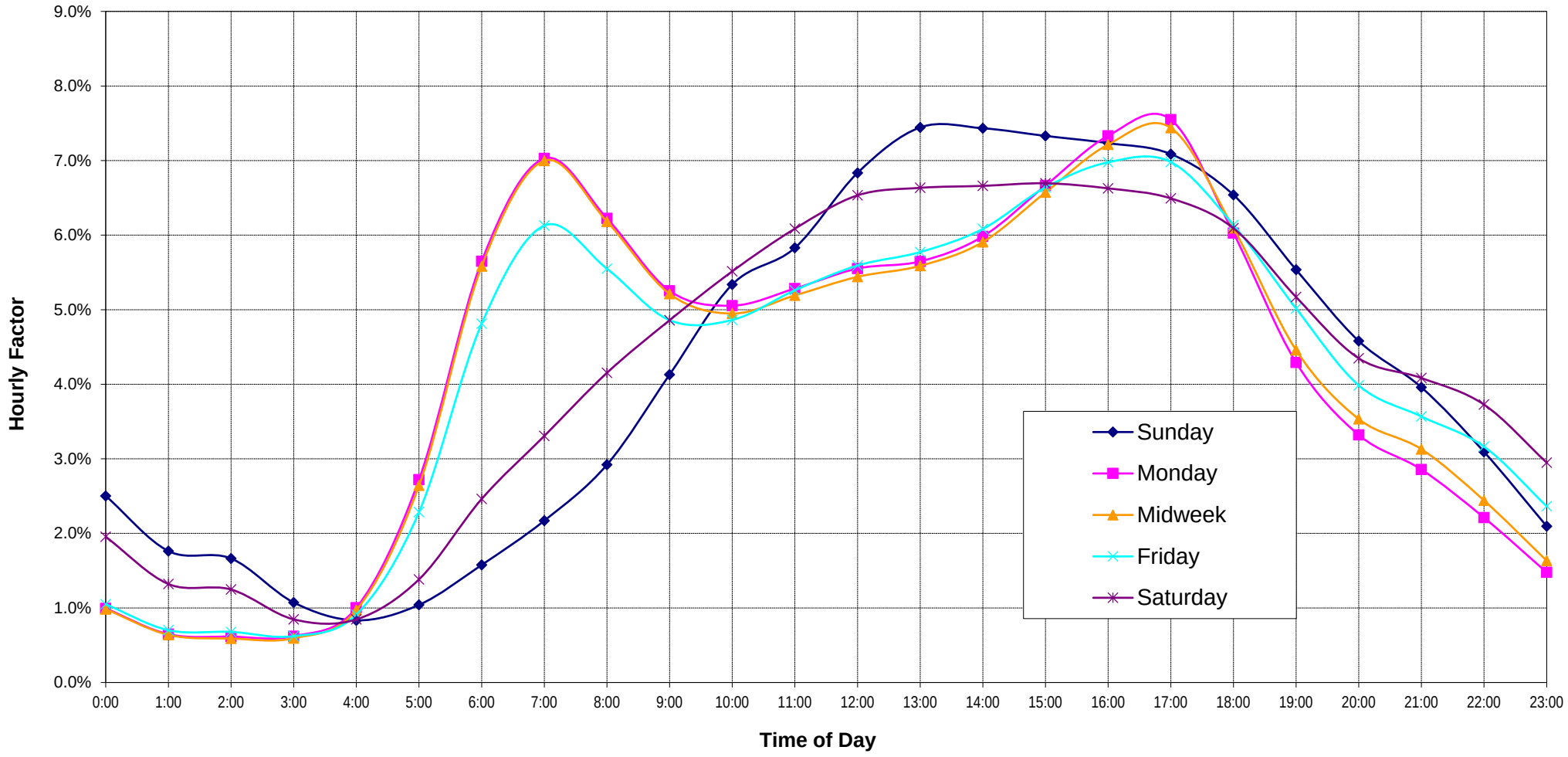
Key Points

- Developed using base network
- Traffic counts used for validation in the model
- VMT increase/decrease over time
- Factors by county or roadway type have high variation

Vehicle Miles of Travel: Nonrecurring Congestion Factor

- Congestion due to incidents, or nonrecurring congestion, not captured in the model
- Congestion due to traffic incidents accounts for twice as much as congestion from bottleneck situations
- Delay caused by nonrecurring congestion is added to the freeway travel times and congestion delay
- This factor is not applied to non-freeway type facilities.

Vehicle Miles of Travel: Hourly VMT Factors



Vehicle Miles of Travel: Seasonal Conversion Factors

Convert to Other Seasons

- Summer
- School
- Annual

- Transportation Conformity
  - Summer/School
- State Implementation Plan
  - Summer/School
- Air Emissions Reporting Requirement(AERR)
  - Annual

Vehicle Miles of Travel: Daily Conversion Factors

Convert to Other Day Types

- Monday
- Weekday
- Friday
- Saturday
- Sunday

- Transportation Conformity
  - Weekday
- State Implementation Plan
  - Monday
  - Weekday
  - Friday
  - Saturday
  - Sunday

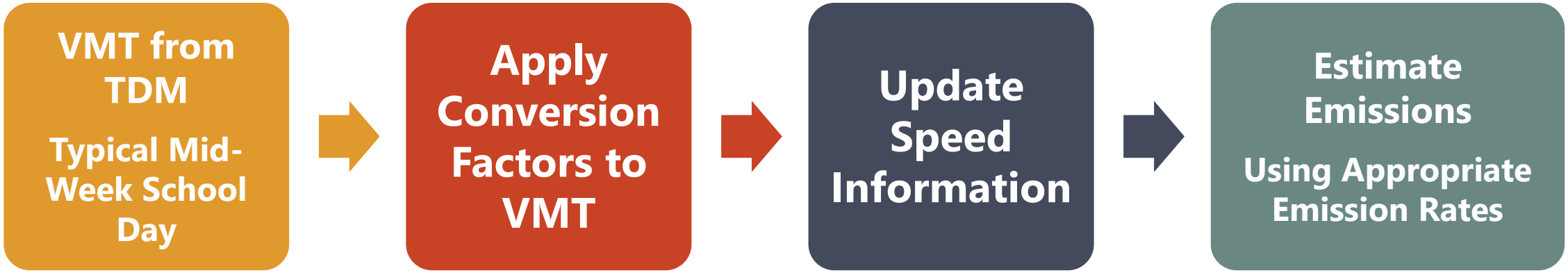
VMT Adjustments: Seasonal & Daily Conversion Factors

- **Example**

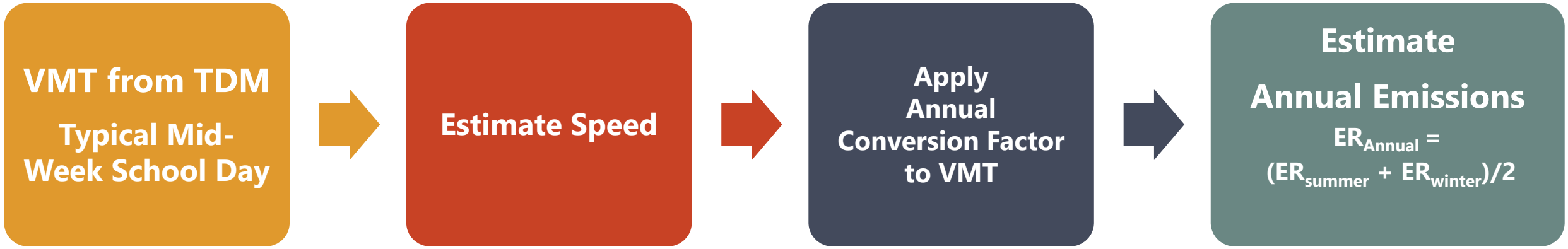
Conversion	Sunday	Monday	Midweek	Friday	Saturday
Average Non-Summer Weekday to Summer Weekday	0.73213	0.95156	1.02486	1.11825	0.89734
Average Non-Summer Weekday to August Weekday	0.70569	0.95685	1.02897	1.10347	0.84958
Average Non-Summer Weekday to School Weekday	0.88331	0.96668	1.00946	1.22129	0.9995

Vehicle Miles of Travel: TDM to Summer Weekday Season

- Running Travel Demand Model (TDM) and MOVES is expensive
- Impractical to run for all day types and seasons



Vehicle Miles of Travel: TDM to Annual



Vehicle Miles of Travel: Conversion Data Source

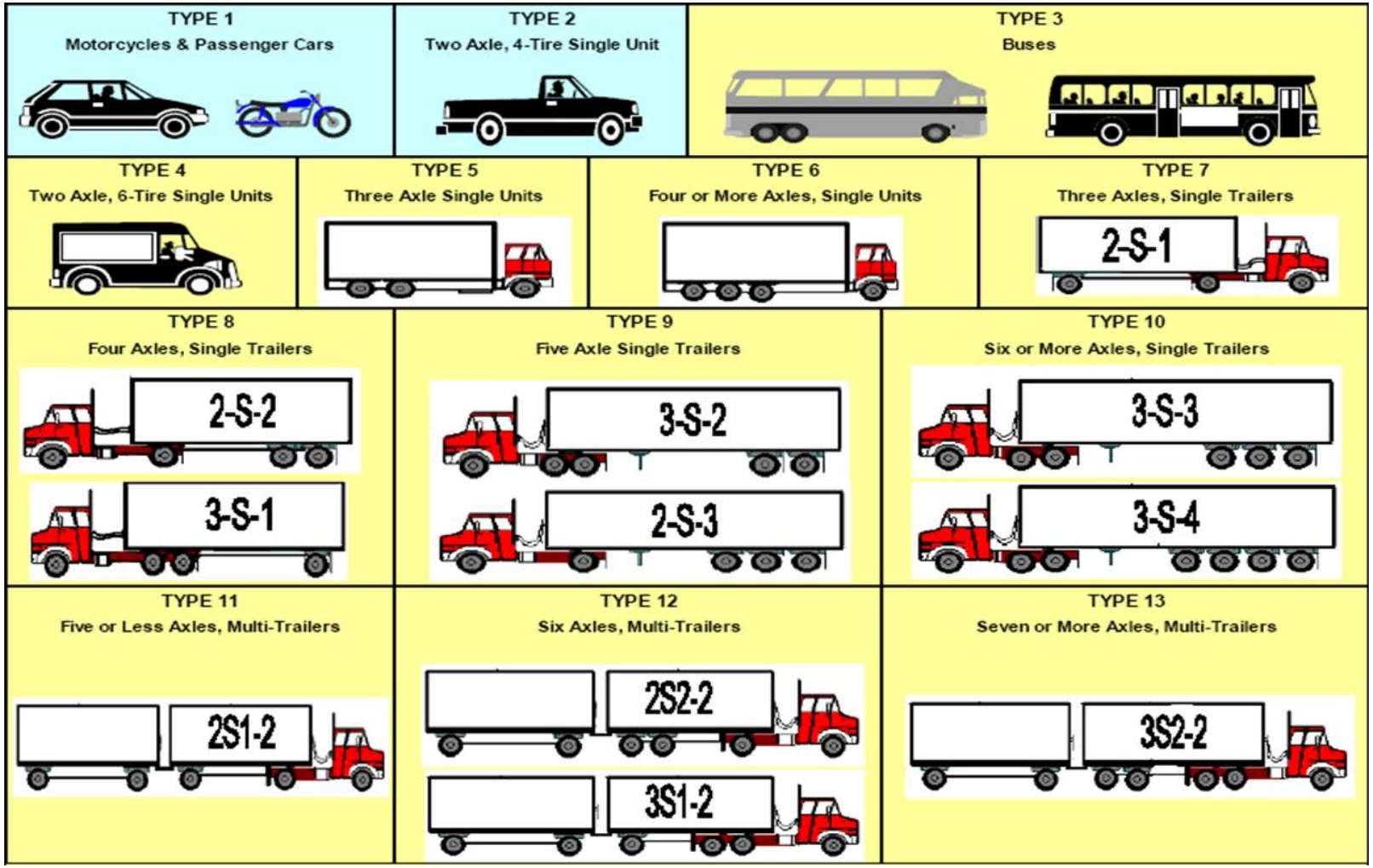
TxDOT

- Automatic Traffic Recorder (ATR) volume data
- 160 permanent sites around the state
- 24h, 365 days, by lane
- Quality controlled and processed into VMT

Regional Emissions Analysis– VMT Mix

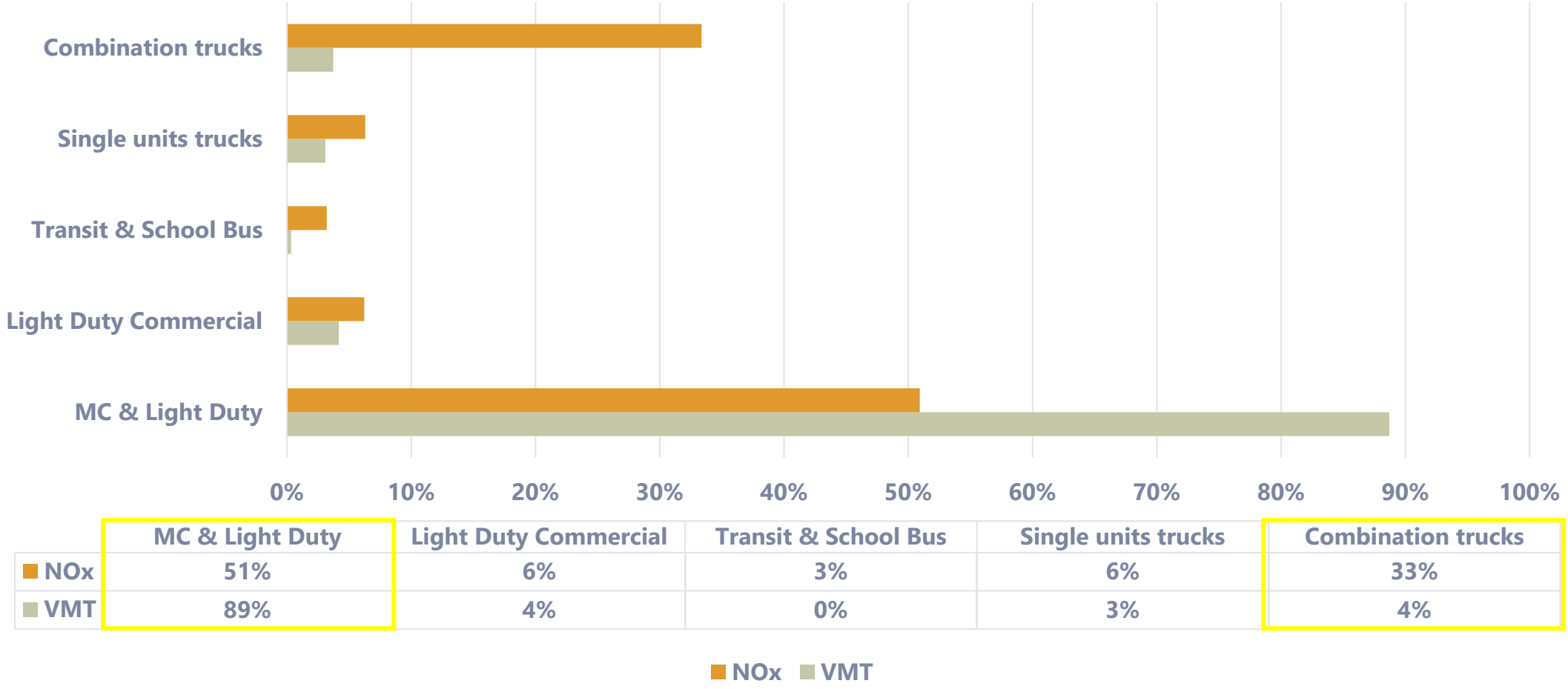
VMT distributed to different vehicle type

Emission factor varies for different vehicle and fuel type



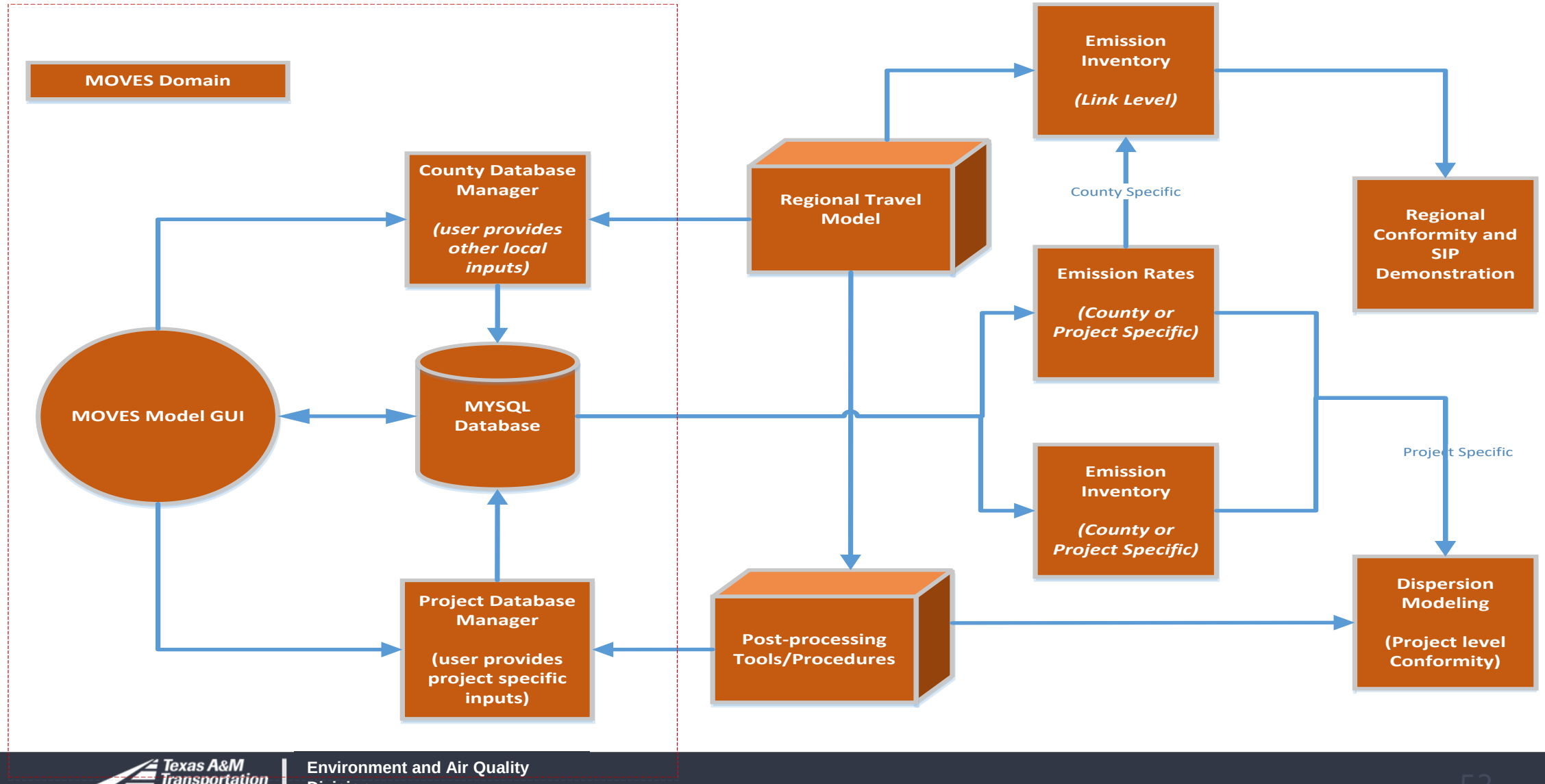
Source - Texas Department of Transportation

Regional Emissions Analysis– VMT Mix Cont'd

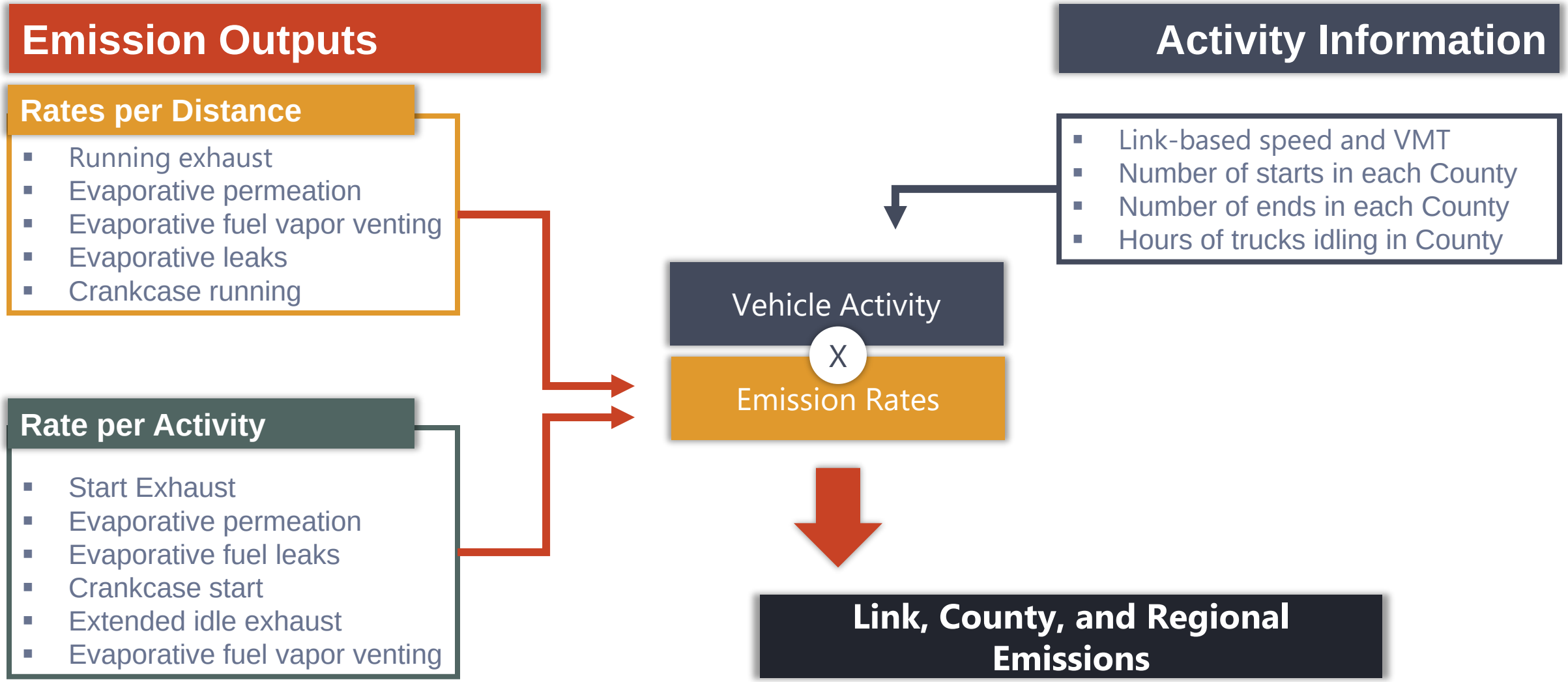


	MC & Light Duty	Light Duty Commercial	Transit & School Bus	Single units trucks	Combination trucks
NOx	51%	6%	3%	6%	33%
VMT	89%	4%	0%	3%	4%

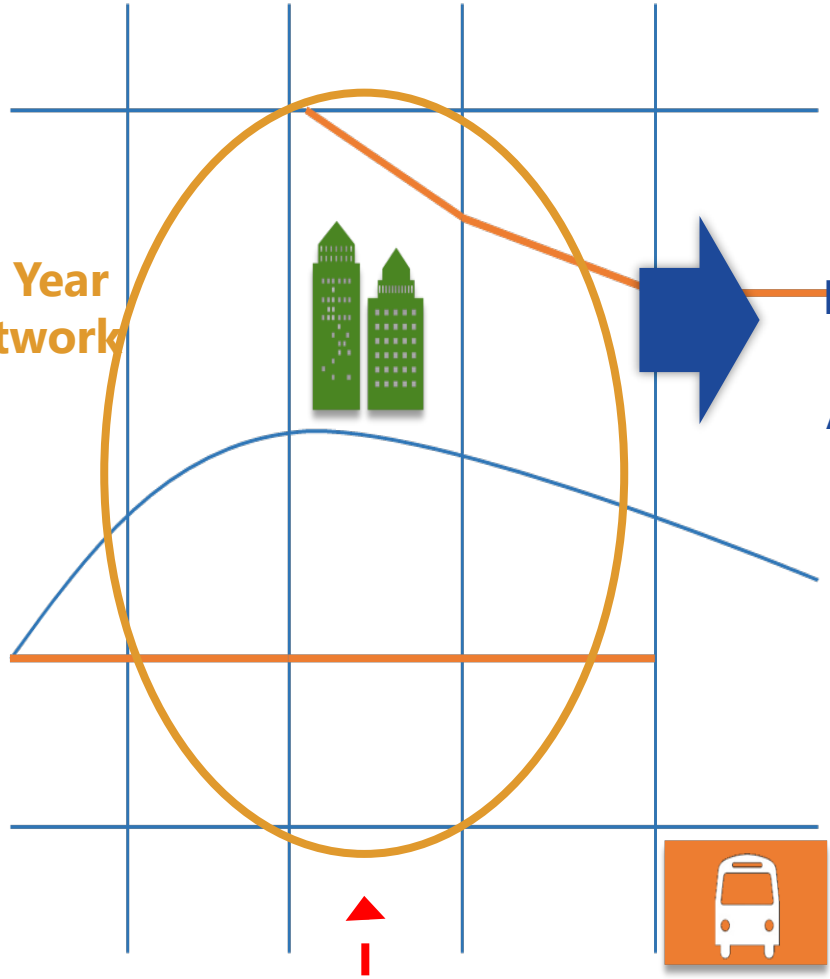
Regional Emissions Analysis– Using MOVES



Regional Emissions Analysis– Using MOVES Cont'd



Regional Emission Analysis for Conformity



Analysis Year 2020 Network

Travel Demand Model AY 2020

Emissions Model

10011
11010

MOVES

Total Amount of Regional Emissions In 2020

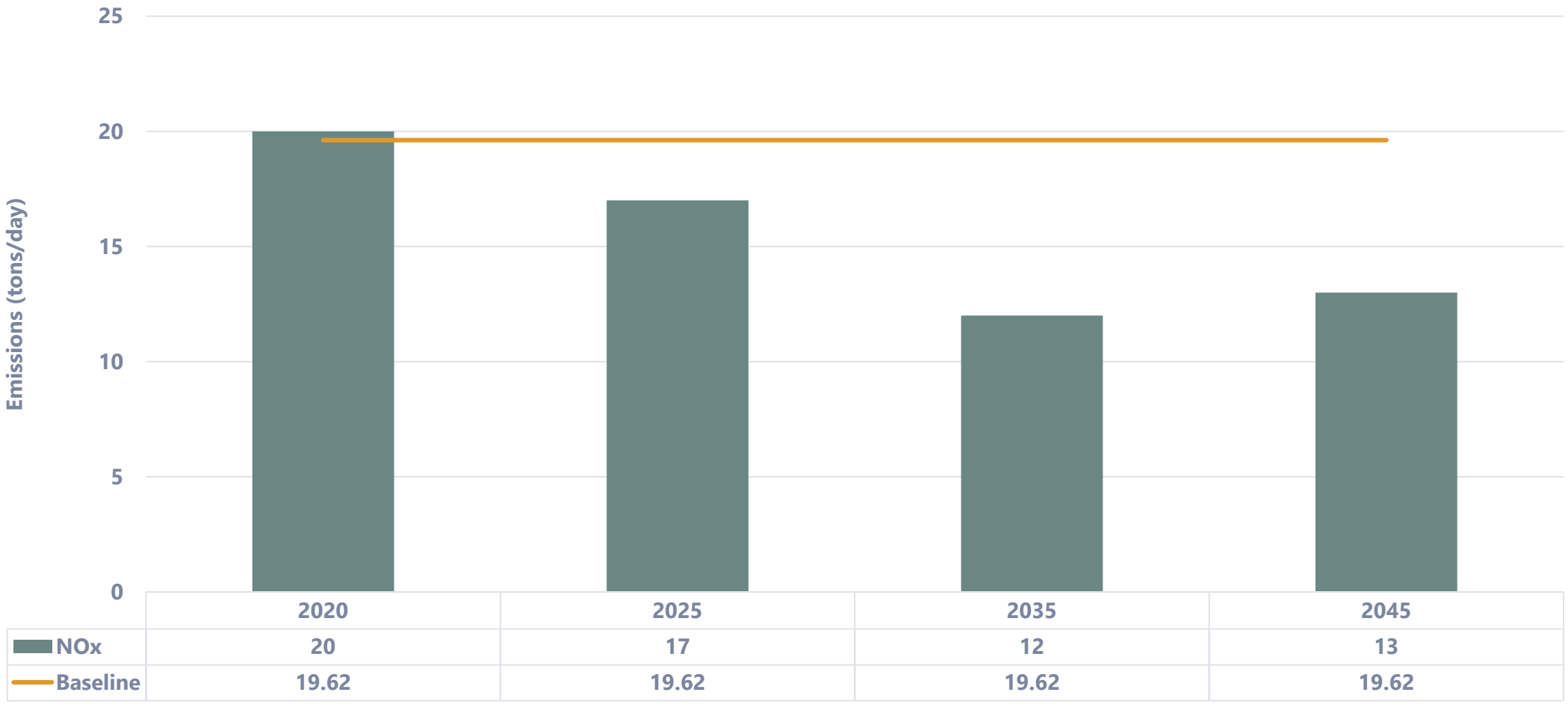
Is this lower than Emissions Budget (MVEB)?

No

Yes

Find a way to reduce emissions

Regional Emission Analysis: Baseline Test Emissions Example



	2020	2025	2035	2045
NOx	20	17	12	13
Baseline	19.62	19.62	19.62	19.62

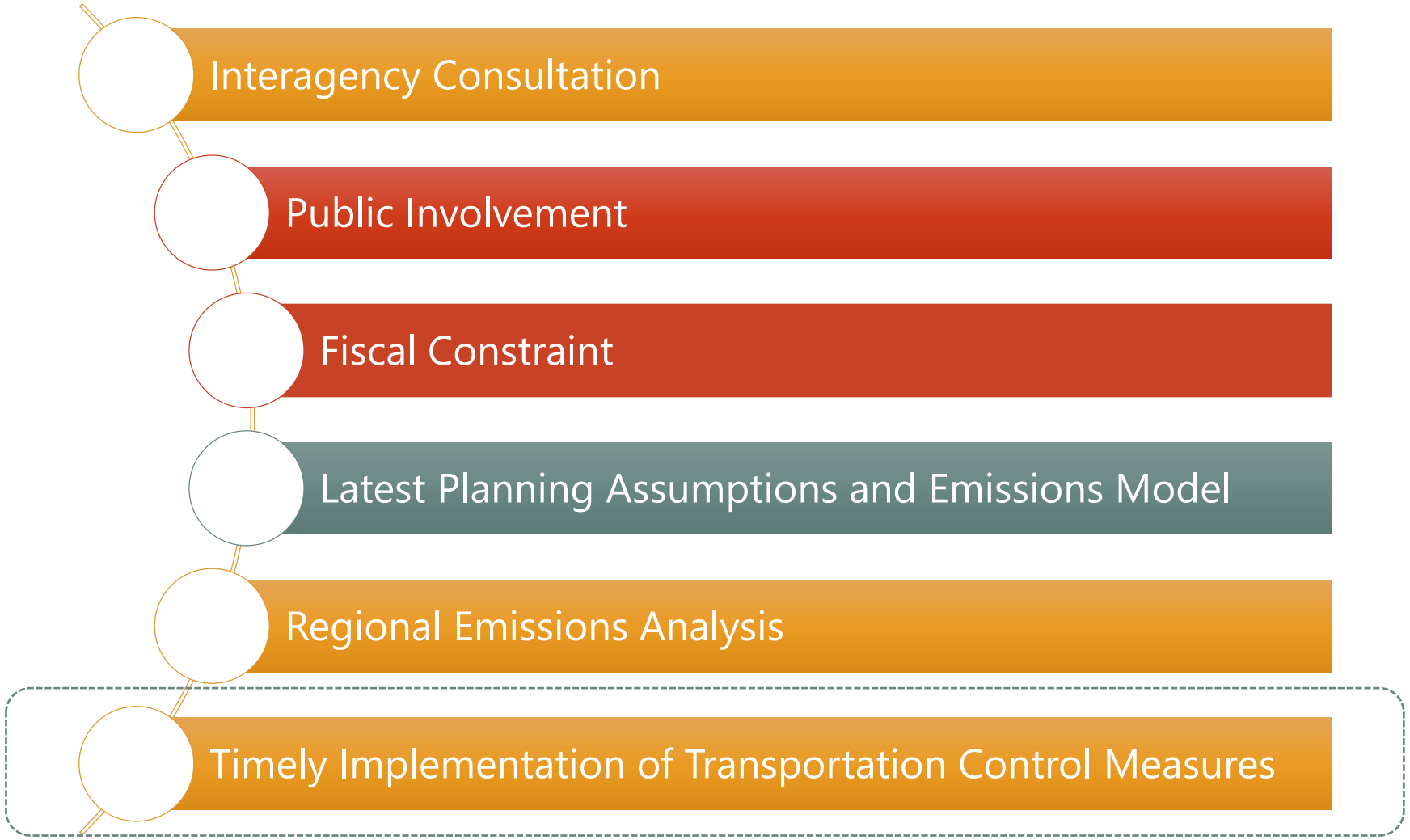
Regional Emission Analysis- Key Pointers

Reviewing agencies often don't have enough expertise in MOVES or other models to adequately review conformity and SIP modeling

Small MPOs sometimes can't afford to develop modeling expertise and contract work out

As a result, modeling mistakes can lead to SIP and conformity problems

Major Components of a Conformity Determination



Timely Implementation of TCMs

Committed in SIP

- Timely implementation of TCMs is required per transportation conformity provisions
- TCM substitution rule allows for TCMs to be substituted without a SIP revision as long as substitute TCM
  - has equivalent or greater emissions reduction
  - follows implementation timeframe in SIP
- Failure has implications on Conformity

No TCMS Committed in SIP

- Use for Conformity
- Modeled control strategies
  - HOV Lanes
  - Grade Separations
  - IM program
- CMAQ requirements if funding source

Regional Emission Analysis: Baseline Test Emissions Example

	2020	2025	2035	2045
NOx	20	17	12	13
Baseline	19.62	19.62	19.62	19.62

Key Pointers

Get involved in the development of the SIP

- Development of TDM model for SIP emissions inventory

Improve knowledge of the Conformity and planning rules & regulations

Plan with all impending milestones

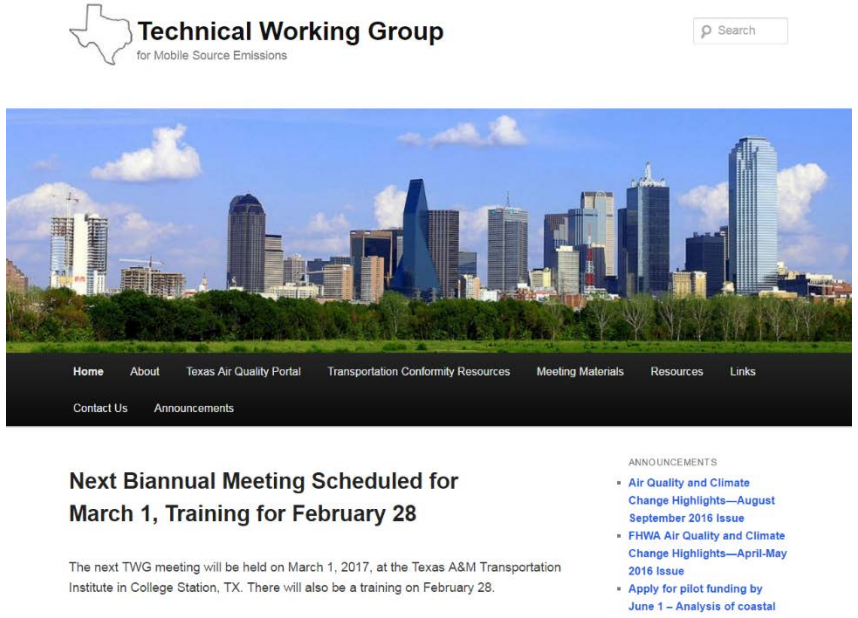
- SIP approval, planning changes, etc.

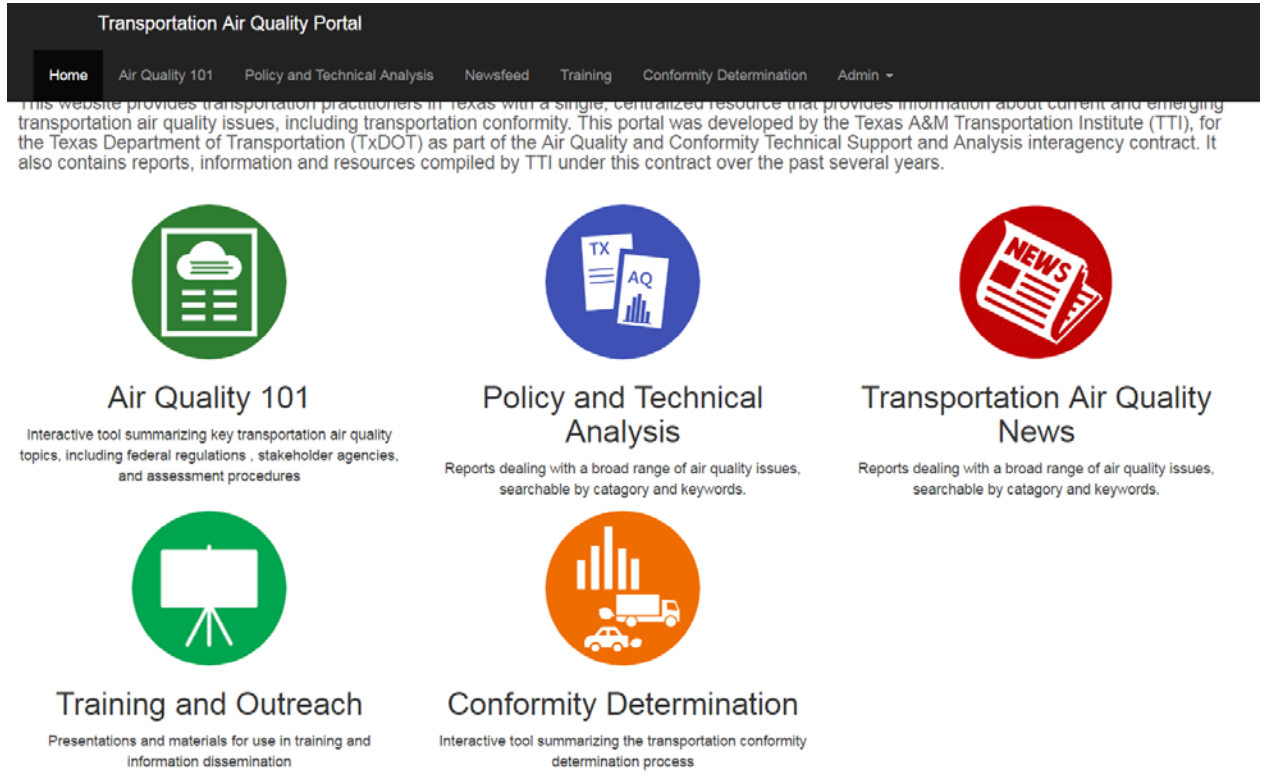
Definitions, process, and inputs cleared with consultation group

Code your project accurately – staging tables

Resources for Texas Practitioners

- TWG website https://www.texastwg.org/
- Conformity documentation and subcommittee activities
- Air quality portal
- MOSERS





MOVES Guidance

MOVES2014 SIP and Conformity Policy Guidance
ww.epa.gov/otaq/models/moves/index.htm#sip-2014a

MOVES2014a Q&A document
www.epa.gov/otaq/models/moves/index.htm#generalinfo-2014a

MOVES2014 and MOVES2014a Technical Guidance
www.epa.gov/otaq/models/moves/index.htm#sip-2014a

FHWA Guidance

FHWA, Air Quality Guidance

- https://www.fhwa.dot.gov/environment/air_quality/conformity/methodologies/moves.cfm